

IN THE CLAIMS

1. (Previously Presented) In a computer system, a method for managing services associated with a plurality of plug-in modules, the method comprising the steps of:

obtaining identities of a plurality of plug-in modules;

based on queries to the plurality of plug-in modules, retrieving a dependency list indicating respective plug-in services provided by, and required by, each plug-in module identified in the identities of a plurality of plug-in modules;

calculating a plug-in initiation order based upon the dependency list indicating respective plug-in services provided by, and required by, each plug-in module; and

initiating service operation of plug-in modules according to the plug-in initiation order, such that if a first plug-in module provides a service required by a second plug-in module, the first plug-in module is initiated such that the service provided by the first plug-in module is available to the second plug-in module when required by the second plug-in module.

2. (Currently Amended) The method of ~~claim 1~~ wherein claim 1, wherein the step of obtaining identities of a plurality of plug-in modules includes the steps of:

receiving a list of services to be started within the computer system ;

determining, for each service in the list of services, a respective plug-in module definition that can provide that service; and

placing the identity of each plug-in module definition determined in the step of determining into the identities of the plurality of plug-in modules.

3. (Currently Amended) The method of claim 1, wherein ~~claim 1 wherein~~ the step of retrieving a dependency list indicating respective plug-in services provided by, and required by, each plug-in module comprises the steps of:

for each plug-in module identified in the identities of a plurality of plug-in modules, performing the steps of:

instantiating the plug-in module based upon a plug-in module definition associated with the identity of the plug-in module;

receiving a dependency response from the plug-in module, the dependency response indicating respective plug-in services provided by, and required by, the plug-in module; and

storing identities of the respective plug-in services provided by, and required by, the plug-in module as identified in the dependency response in the dependency list.

4. (Currently Amended) The method of claim 3, wherein ~~claim 3 wherein~~ the step of instantiating the plug-in module comprises the steps of:

obtaining plug-in initiation information corresponding to the plug-in module definition associated with the identity of the plug-in module;

instantiating the plug-in module based upon a plug-in module definition associated with the identity of the plug-in module; and

passing the plug-in initiation information to the plug-in module for use by the plug-in module.

5. (Currently Amended) The method of claim 3, wherein ~~claim 3 wherein~~ the step of instantiating the plug-in module comprises the step of:

querying a dependency interface associated with the plug-in module with a dependency query to obtain the dependency response from the plug-in module.

6. (Currently Amended) The method of claim 1, wherein ~~claim 1 wherein~~ the step of calculating a plug-in initiation order based upon the dependency list comprises the step of:

arranging a placement of each plug-in module identified in the dependency list within the plug-in initiation order such that plug-in modules not requiring services provided by other plug-in modules are placed earlier in the initiation order and such that plug-in modules requiring services provided by other plug-in modules are placed later in the initiation order.

7. (Currently Amended) The method of claim 6, wherein ~~claim 6 wherein~~ the step of arranging placement of each plug-in module identified in the dependency list within the plug-in initiation order comprises the steps of:

analyzing the dependency list indicating respective plug-in services provided by, and required by, each plug-in module to determine which plug-ins provide services relied upon by other plug-in modules; and

creating, as the plug-in initiation order, at least one plug-in module dependency tree based on the step of analyzing, the at least one plug-in module dependency tree containing a hierarchical arrangement of nodes associated with respective plug-in modules, the hierarchical arrangement indicating the plug-in initiation order of the plug-in modules respectively associated with the nodes in the dependency tree.

8. (Currently Amended) The method of claim 7, wherein ~~claim 7 wherein~~ initiating service operation of plug-in modules according to the plug-in initiation order comprises:

traversing the at least one plug-in module dependency tree according to the hierarchical arrangement of nodes and for each node encountered during the step of traversing, initiating service operation of the respective plug-in module associated with that node.

9. (Currently Amended) The method of claim 8, wherein ~~claim 8 wherein~~ the step of initiating service operation of plug-in modules includes:

forwarding, via a dependency available interface associated with a respective plug-in module, a list of initiated plug-in services of other plug-in modules that are currently available for use by the respective plug-in module.

10. (Currently Amended) The method of claim 1, wherein ~~claim 1 wherein~~ the step of initiating service operation of plug-in modules according to the plug-in initiation order comprises performing, for each respective plug-in module in the plug-in initiation order, the steps of:

determining, from a published list of services available by initiated plug-in modules, an identity of each initiated plug-in service required by the respective plug-in module;

forwarding to the respective plug-in module, via a dependency available interface associated with the respective plug-in module, the identity of each initiated plug-in service required by the respective plug-in module;

receiving a list of services initiated by the respective plug-in module; and

adding the list of services provided by the respective plug-in module to the published list of services.

11. (Currently Amended) The method of claim 1, wherein ~~claim 1, wherein~~ the step of initiating service operation of plug-in modules according to the plug-in initiation order operates such that if the second plug-in module requires a service provided by the first plug-in module, the second plug-in module is initiated such that the service provided by the first plug-in module is available to the second plug-in module when required.

12. (Currently Amended) The method of claim 1, wherein ~~claim 1 wherein~~ the first plug-in module is initiated via the step of initiating service operation of plug-in modules prior to initiation of the second plug-in module.

13. (Currently Amended) The method of claim 1, wherein ~~claim 1 wherein~~ the first plug-in module is initiated via the step of initiating operation of plug-in modules after initiation of the second plug-in module, and wherein the second plug-in module includes a wait-state operation causing the second plug-in module to wait to provide the service offered by the second plug-in module until initiation of the first plug-in module.

14. (Currently Amended) The method of claim 1, wherein ~~claim 1 wherein~~ the steps of obtaining, retrieving, calculating and initiating are performed by a multi-threaded plug-in manager and wherein the step of calculating a plug-in initiation order is performed by collectively operating a respective thread for each plug-in, each thread performing the step of initiating service operation of at least one plug-in module when all services required by that plug-in module are available.

15. (Previously Presented) A computer system comprising:

- a memory;
  - a processor; and
  - an interconnection mechanism coupling the memory and the processor;
- wherein the memory is encoded with a plug-in manager application that, when performed on the processor, produces a plug-in manager process that manages services associated with a plurality of plug-in modules encoded within the memory by performing the operation steps of:
- obtaining identities of a plurality of plug-in modules in the memory;
  - based on queries to the plurality of plug-in modules, retrieving, into the memory, a dependency list indicating respective plug-in services provided by, and required by, each plug-in module identified in the identities of a plurality of plug-in modules;

calculating, in the memory, a plug-in initiation order based upon the dependency list indicating respective plug-in services provided by, and required by, each plug-in module; and

initiating service operation of plug-in modules on the processor according to the plug-in initiation order, such that if a first plug-in module provides a service required by a second plug-in module, the first plug-in module is initiated such that the service provided by the first plug-in module is available to the second plug-in module when required by the second plug-in module.

16. (Currently Amended) The computer system of claim 15, wherein ~~claim 15~~ ~~wherein~~ when the plug-in manager process performs the step of obtaining identities of a plurality of plug-in modules, the plug-in manager process performs the steps of:

receiving a list of services to be started within the computer system;  
determining, for each service in the list of services, a respective plug-in module definition that can provide that service; and  
placing the identity of each plug-in module definition determined in the step of determining into the identities of the plurality of plug-in modules.

17. (Currently Amended) The computer system of claim 15, wherein ~~claim 15~~ ~~wherein~~ when the plug-in manager process performs the step of retrieving a dependency list indicating respective plug-in services provided by, and required by, each plug-in module, the plug-in manager process performs the steps of:

for each plug-in module identified in the identities of a plurality of plug-in modules, performing the steps of:  
instantiating the plug-in module in the memory based upon a plug-in module definition associated with the identity of the plug-in module;  
receiving a dependency response from the plug-in module, the dependency response indicating respective plug-in services provided by, and required by, the plug-in module; and

storing, in the memory, identities of the respective plug-in services provided by, and required by, the plug-in module as identified in the dependency response in the dependency list.

18. (Currently Amended) The computer system of claim 17, wherein ~~claim 17 wherein~~ when the plug-in manager process performs the step of instantiating the plug-in module, the plug-in manager process performs the steps of:

obtaining, in the memory, plug-in initiation information corresponding to the plug-in module definition associated with the identity of the plug-in module;

instantiating the plug-in module in the memory based upon a plug-in module definition associated with the identity of the plug-in module; and

passing the plug-in initiation information to the plug-in module in the memory for use by the plug-in module.

19. (Currently Amended) The computer system of claim 17, wherein ~~claim 17 wherein~~ when the plug-in manager process performs the step of instantiating the plug-in module, the plug-in manager process performs the step of:

querying a dependency interface associated with the plug-in module with a dependency query to obtain the dependency response from the plug-in module.

20. (Currently Amended) The computer system of claim 15, wherein ~~claim 15 wherein~~ when the plug-in manager process performs the step of calculating a plug-in initiation order based upon the dependency list, the plug-in manager process performs the step of:

arranging a placement of each plug-in module identified in the dependency list within the plug-in initiation order such that plug-in modules not requiring services provided by other plug-in modules are placed earlier in the initiation order and such that plug-in modules requiring services provided by other plug-in modules are placed later in the initiation order.

21. (Currently Amended) The computer system of claim 20, wherein ~~claim 20~~ wherein when the plug-in manager process performs the step of arranging placement of each plug-in module identified in the dependency list within the plug-in initiation order, the plug-in manager process performs the steps of:

analyzing the dependency list indicating respective plug-in services provided by, and required by, each plug-in module to determine which plug-ins provide services relied upon by other plug-in modules; and

creating in the memory, as the plug-in initiation order, at least one plug-in module dependency tree based on the step of analyzing, the at least one plug-in module dependency tree containing a hierarchical arrangement of nodes associated with respective plug-in modules, the hierarchical arrangement indicating the plug-in initiation order of the plug-in modules respectively associated with the nodes in the dependency tree.

22. (Currently Amended) The computer system of claim 21, wherein ~~claim 21~~ wherein when the plug-in manager process performs the step of initiating service operation of plug-in modules according to the plug-in initiation order, the plug-in manager process performs the step of:

traversing the at least one plug-in module dependency tree in the memory according to the hierarchical arrangement of nodes and for each node encountered during the step of traversing, initiating service operation of the respective plug-in module associated with that node.

23. (Currently Amended) The computer system of claim 22, wherein ~~claim 22~~ wherein when the plug-in manager process performs the step of initiating service operation of the respective plug-in module associated with that node, the plug-in manager process performs the step of:



forwarding, via a dependency available interface associated with the respective plug-in module, a list of initiated plug-in services of other plug-in modules that are currently available for use by the respective plug-in module.

24. (Currently Amended) The computer system of claim 15, wherein ~~claim 15~~ ~~wherein~~ when the plug-in manager process performs the step of initiating service operation of plug-in modules according to the plug-in initiation order the plug-in manager process performs, for each respective plug-in module in the plug-in initiation order, the steps of:

determining, from a published list of services available by initiated plug-in modules, an identity of each initiated plug-in service required by the respective plug-in module;

forwarding to the respective plug-in module, via a dependency available interface associated with the respective plug-in module, the identity of each initiated plug-in service required by the respective plug-in module;

receiving a list of services initiated by the respective plug-in module; and  
adding the list services provided by the respective plug-in module to the published list of services.

25. (Original) The computer system of claim 15, wherein the step of initiating service operation of plug-in modules according to the plug-in initiation order operates in the plug-in manager process such that if the second plug-in module requires a service provided by the first plug-in module, the second plug-in module is initiated such that the service provided by the first plug-in module is available to the second plug-in module when required.

26. (Currently Amended) The computer system of claim 15, wherein ~~claim 15~~ ~~wherein~~ the plug-in manager initiates the first plug-in module via the step of initiating service operation of plug-in modules prior to initiation of the second plug-in module.

27. (Currently Amended) The computer system of claim 15, wherein claim 15 ~~wherein~~ the plug-in manager process initiates the first plug-in module via the step of initiating operation of plug-in modules after initiation of the second plug-in module, and wherein the second plug-in module includes a wait-state operation causing the second plug-in module to wait to provide the service offered by the second plug-in module until initiation of the first plug-in module.

28. (Currently Amended) The computer system of claim 15, wherein claim 15 ~~wherein~~ the steps of obtaining, retrieving, calculating and initiating are performed by a multi-threaded plug-in manager and wherein the step of calculating a plug-in initiation order is performed by collectively operating a respective thread for each plug-in, each thread performing the step of initiating service operation of at least one plug-in module when all services required by that plug-in module are available.

29. (Previously Presented) A computer program product having a computer-readable medium including computer program logic encoded thereon, that when executed on a computer system having a coupling of a memory and a processor, provides a plug-in manager process for managing plug-in services by causing the processor to perform the operations of:

obtaining identities of a plurality of plug-in modules in the memory;

retrieving, into the memory, a dependency list indicating respective plug-in services provided by, and required by, each plug-in module identified in the identities of a plurality of plug-in modules;

calculating, in the memory, a plug-in initiation order based upon the dependency list indicating respective plug-in services provided by, and required by, each plug-in module;

initiating service operation of plug-in modules on the processor according to the plug-in initiation order, such that if a first plug-in module provides a service

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required by a second plug-in module, the first plug-in module is initiated such that the service provided by the first plug-in module is available to the second plug-in module when required by the second plug-in module; and

querying a dependency interface associated with the plug-in module with a dependency query to obtain a dependency response from the plug-in module, the dependency response indicating respective plug-in services provided by the plug-in module.

30. (Previously Presented) A computer system comprising:

a memory;

a processor; and

an interconnection mechanism coupling the memory and the processor;

wherein the memory is encoded with a plug-in manager application that, when performed on the processor, produces a plug-in manager process that manages services associated with a plurality of plug-in modules encoded within the memory by operating on the computer system and causing the computer system to provide:

means for obtaining identities of a plurality of plug-in modules in the memory;

means for retrieving, into the memory, a dependency list indicating respective plug-in services provided by, and required by, each plug-in module identified in the identities of a plurality of plug-in modules;

means for calculating, in the memory, a plug-in initiation order based upon the dependency list indicating respective plug-in services provided by, and required by, each plug-in module;

means for initiating service operation of plug-in modules on the processor according to the plug-in initiation order, such that if a first plug-in module provides a service required by a second plug-in module, the first plug-in module is initiated such that the service provided by the first plug-in module is available to the second plug-in module when required by the second plug-in module; and

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wherein the first plug-in module is initiated via the step of initiating operation of plug-in modules after initiation of the second plug-in module, and wherein the second plug-in module includes a wait-state operation causing the second plug-in module to wait to provide the service offered by the second plug-in module until initiation of the first plug-in module.

31. (Previously Presented) The A computer program product as in claim 29, wherein the processor further performs operations of:

determining a list of plug-in services required by a software application; and

querying a set of plug-in modules to identify services provided by the set of plug-in modules.

32. (Previously Presented) The A-computer program product as in claim 31, wherein the processor further performs operations of:

in response to querying the set of plug-in modules, identifying plug-in modules not identified by the software application as being necessary but which are identified by the set of plug-in modules as being necessary to carry out execution of an operation on behalf of the software application.

33. (Previously Presented) The A-computer program product as in claim 32, wherein the processor further performs operations of:

initiating service operation of plug-in modules on the processor according to an order other than the plug-in initiation order, such that if a third plug-in module provides a service required by a fourth plug-in module, the third plug-in module being initiated after initiation of the fourth plug-in module, the third plug-in module initiating a wait state operation

causing the third plug-in module to wait to provide the service offered by the third plug-in module until instantiation of the fourth plug-in module.

34. (Previously Presented) The A-computer program product as in claim 32, wherein the processor initiates execution of the first plug-in module before execution of the second plug-in module, the first plug-in module initiating a wait state operation resulting in signaling to the second plug-in module, the signaling indicating that a respective service of the first plug-in module is not yet available to the second plug-in module.
35. (Previously Presented) The A-computer program product as in claim 34, wherein the processor further performs operations of:
- maintaining a list of services for a set of plug-in modules currently able to provide respective services; and
  - publishing the list of services for the software application to identify instantiated plug-ins currently providing the respective services.
36. (New) The computer program product as in claim 29, wherein initiating service operation of the plug-in modules includes:
- initiating at least partial concurrent execution of the first plug-in module and the second plug-in module even though the second plug-in module requires the service provided by the first plug-in module.
37. (New) The computer program product as in claim 29, wherein initiating service operation of the plug-in modules includes initiating execution of a first plug-in module that implements a wait state operation, the wait state operation causing the first plug-in module to signal to a dependent second plug-in module that a respective service is not available.

38. (New) The method as in claim 1, wherein initiating service operation of the plug-in modules includes initiating at least partial concurrent execution of the first plug-in module and the second plug-in module.
39. (New) The method as in claim 38, wherein the second plug-in module depends on a given service provided by the first plug-in module
40. (New) The method as in claim 39, wherein initiating service operation of the plug-in modules enables communication between the first plug-in module and the second plug-in module to enable each other to indicate when the given service is available.
41. (New) The method as in claim 40, wherein during the at least partial concurrent execution, the first plug-in module initiates a wait state and notifies the second plug-in module that the first plug-in module is available for service processing.
42. (New) The method as in claim 40, wherein during the at least partial concurrent execution, the first plug-in module initiates a wait state and notifies the second plug-in module that the first plug-in module is waiting for the second plug-in module to provide a particular service.
43. (New) The method as in claim 1 further comprising:
  - utilizing services of initiated plug-in modules for purposes of managing resources associated with a respective storage area network.